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NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
NDIA
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Evolution of Open System Architectures in support of T&E for Naval Combat Systems

Ted Mulder, Senior Systems Engineer
Robert Mueller, Senior Test Engineer

NAVSEA, Port Hueneme, Surface Warfare Center Division
Detachment San Diego

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Introduction

- **NAVSEA PHD DSD Mission**
  - **Combat System Integration Testing (CSIT)**
  - **Battle Group Interoperability Testing (BGIT)**
  - **CEC West Coast Land Based Test Site (LBTS)**
- **Naval Combat Systems – Past & Present**
  - **Review legacy systems when proprietary and MIL-STD ruled the day**
  - **Present current systems such as the CVN-76 SSDS MK2**
- **T&E Tools**
  - **Hardware-In-The-Loop (HWIL) Simulation/Stimulation Systems**
  - **Data Collection and Analysis**
  - **Future initiatives**
- **Benefits of Open System Architectures (OSA)**
  - **T&E Benefits**
  - **Tradeoffs**

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Our Mission

- Land-based reliability testing, integration, and certification of surface ship combat systems and computer networks both prior to initial operation and for in-service systems;
- Design, development, and life cycle maintenance of standardized simulation systems;
- Land-based facilities and services for the analysis of performance of in-service combat systems, subsystems, and equipment for afloat units;
- Provide engineering and technical support for test and development of command and control systems

Performs CSIT & BGIT for non-Aegis Surface Comba

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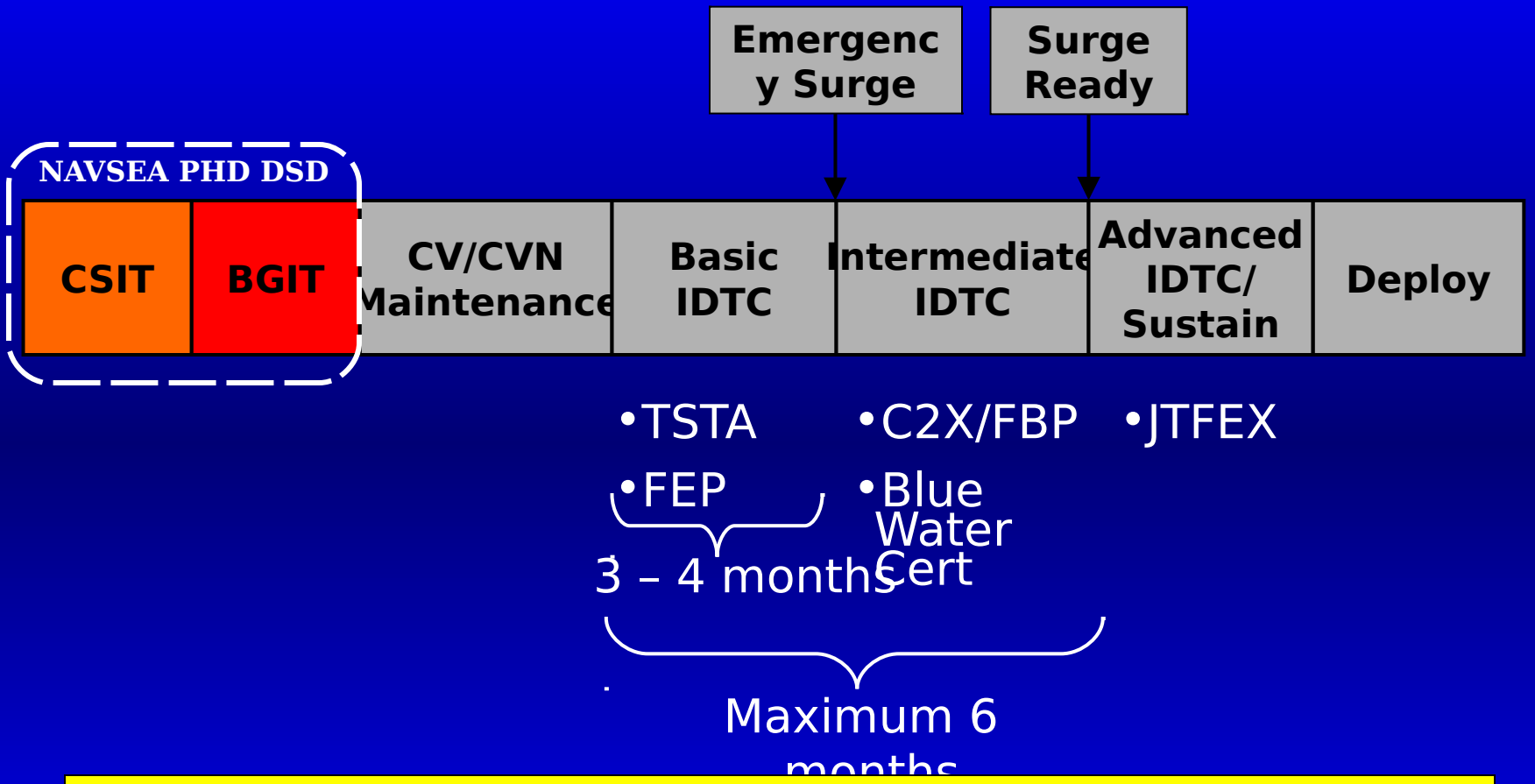
CSIT/BGIT in the Fleet Response Plan (FRP)



Supporting Emergency Surge Is The Focus

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CSIT Description

Integration Phase

Low level subsystem tests designed to allow for rapid program fault isolation and correction.

- **Interface Validation**
- **Functional Operability**

Demonstration Phase

Higher level of Combat System Testing that demonstrates that the integration of the Combat System performs IAW governing specification. Program change is not as fluid as in the previous phase.

- **Multi Platform Interoperability Test**
- **Single / Multiple Warfare**
- **Functional Stress**
- **Performance Test**
- **Stress and Endurance**

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Definition of an Open System

"A system that implements sufficient open standards for interfaces, services, and supporting formats to enable properly engineered components to be utilized across a wide range of systems with minimal changes, to interoperate with other components on local and remote systems, and to interact with users in a style that facilitates portability. An open system is characterized by the following:

- **well defined, widely used, preferably non-proprietary interfaces/protocols;**
- **use of standards which are developed/adopted by recognized standards bodies or the commercial market place;**
- **definition of all aspects of system interfaces to facilitate new or additional systems capabilities for a wide range of applications; and**
- **explicit provision for expansion or upgrading through**

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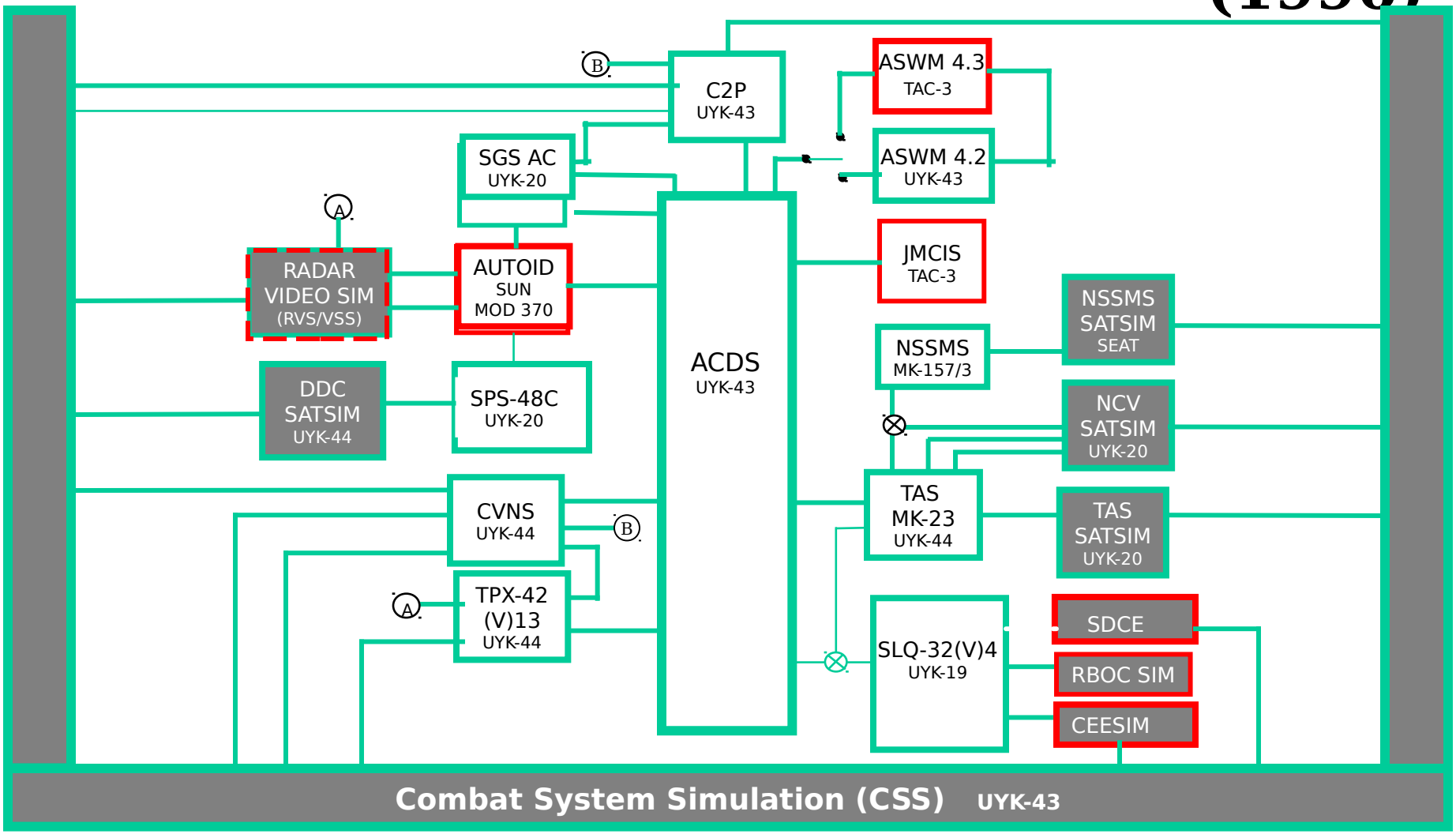
CV-63 (ACDS BK0) Test Bed (1996)



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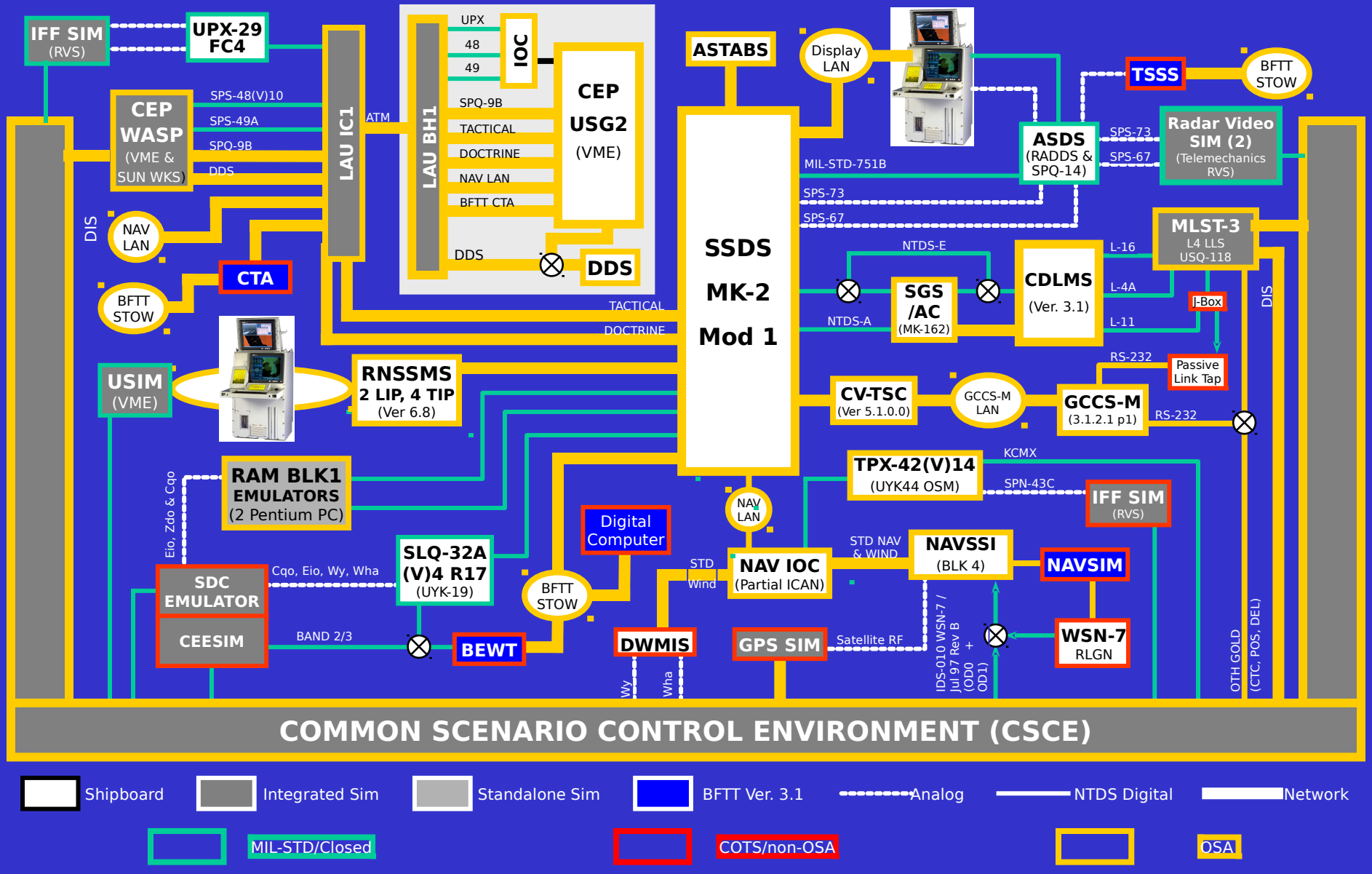
CVN-76 (SSDS MK2) Test Bed



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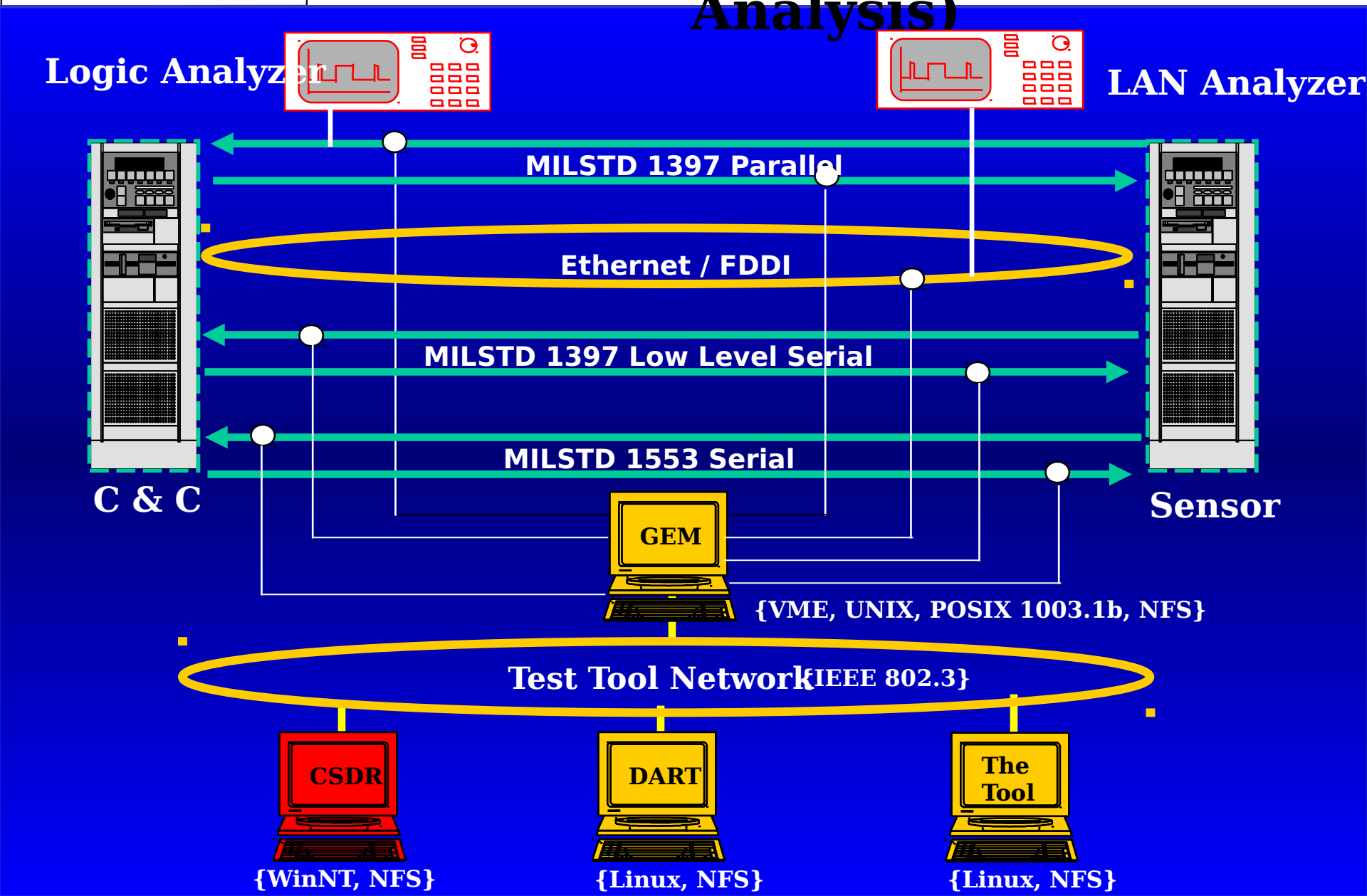
Test Tools (Data Collection & Analysis)



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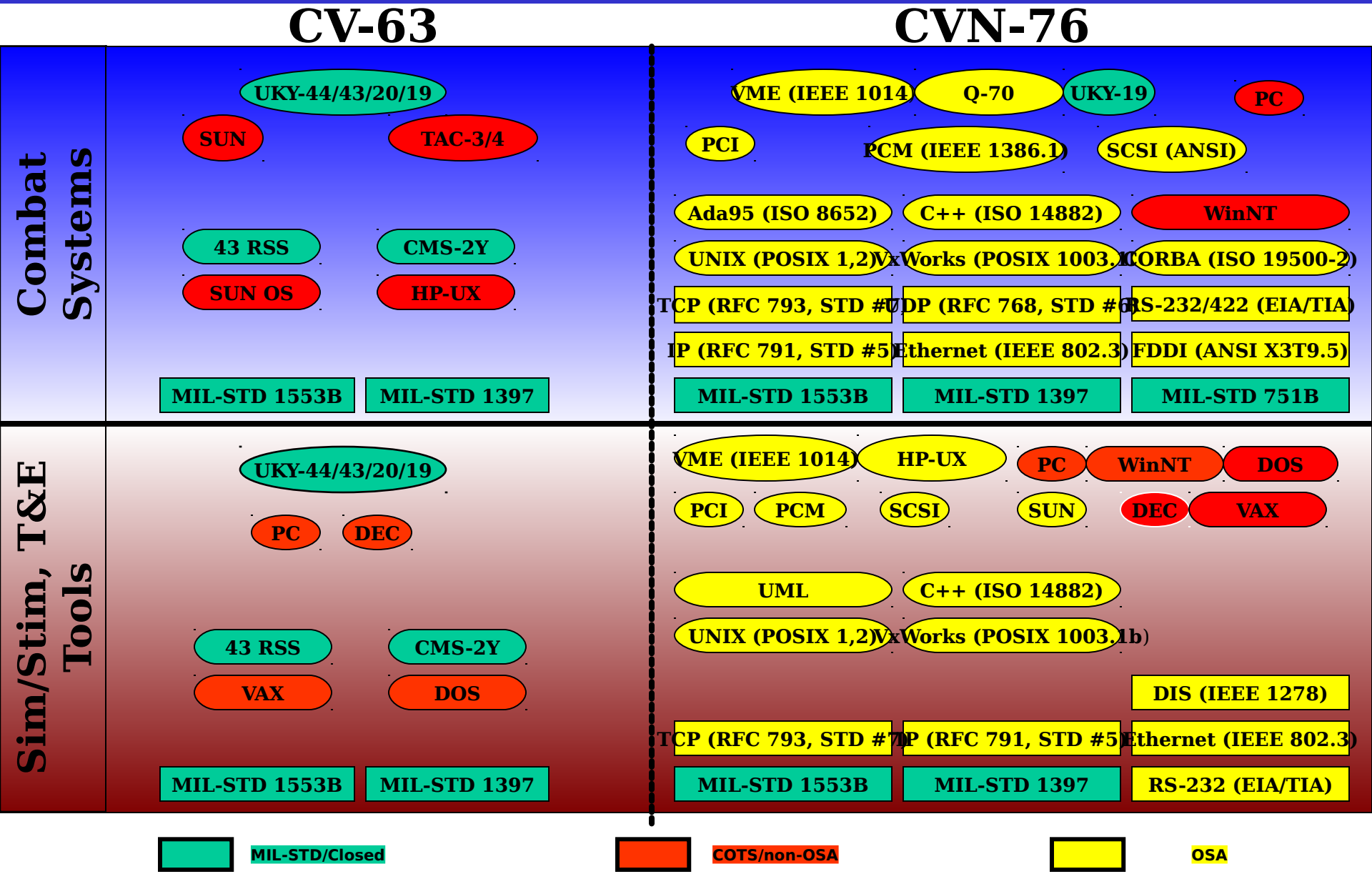
Interface & Standards Evolution



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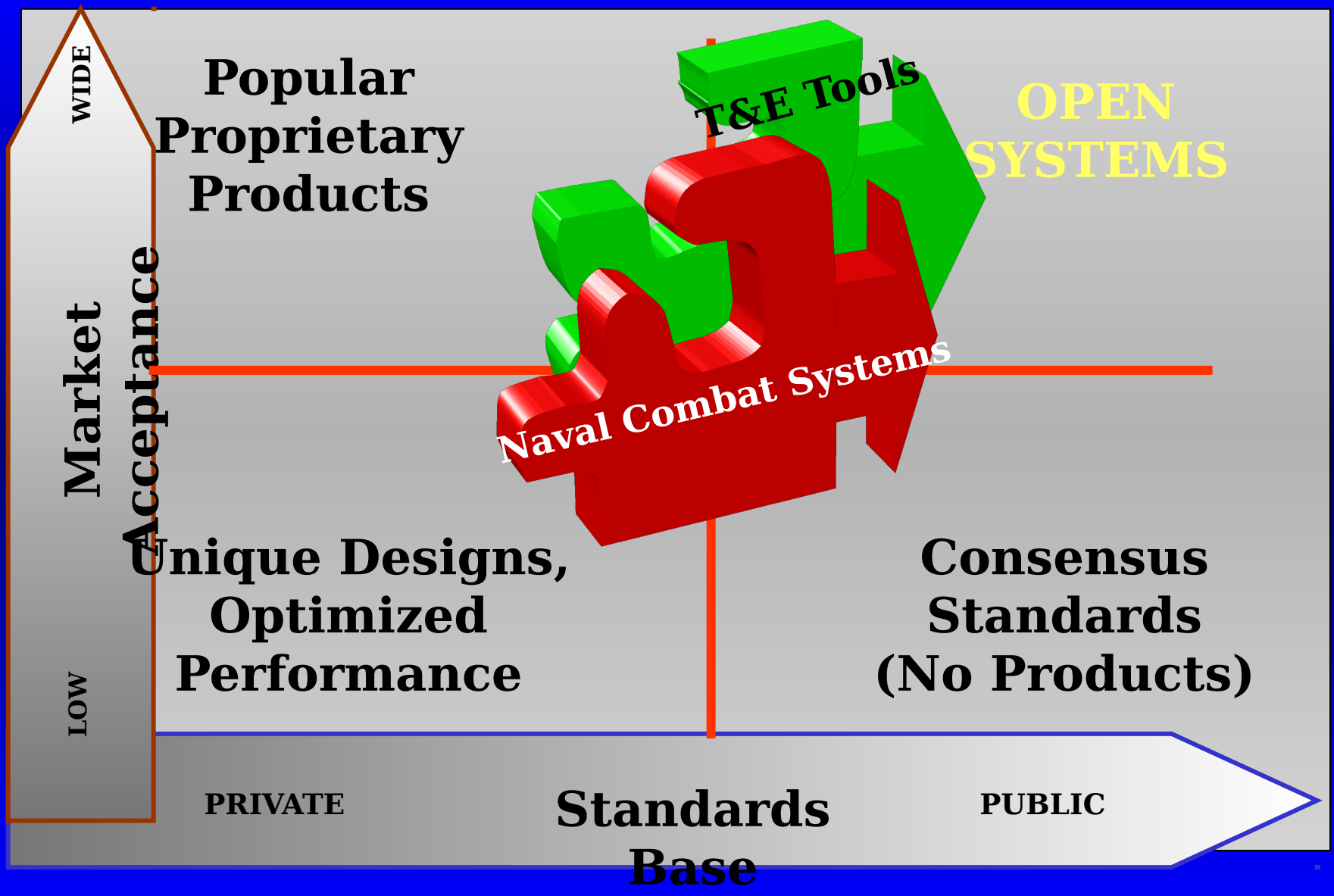
Progression towards OSA



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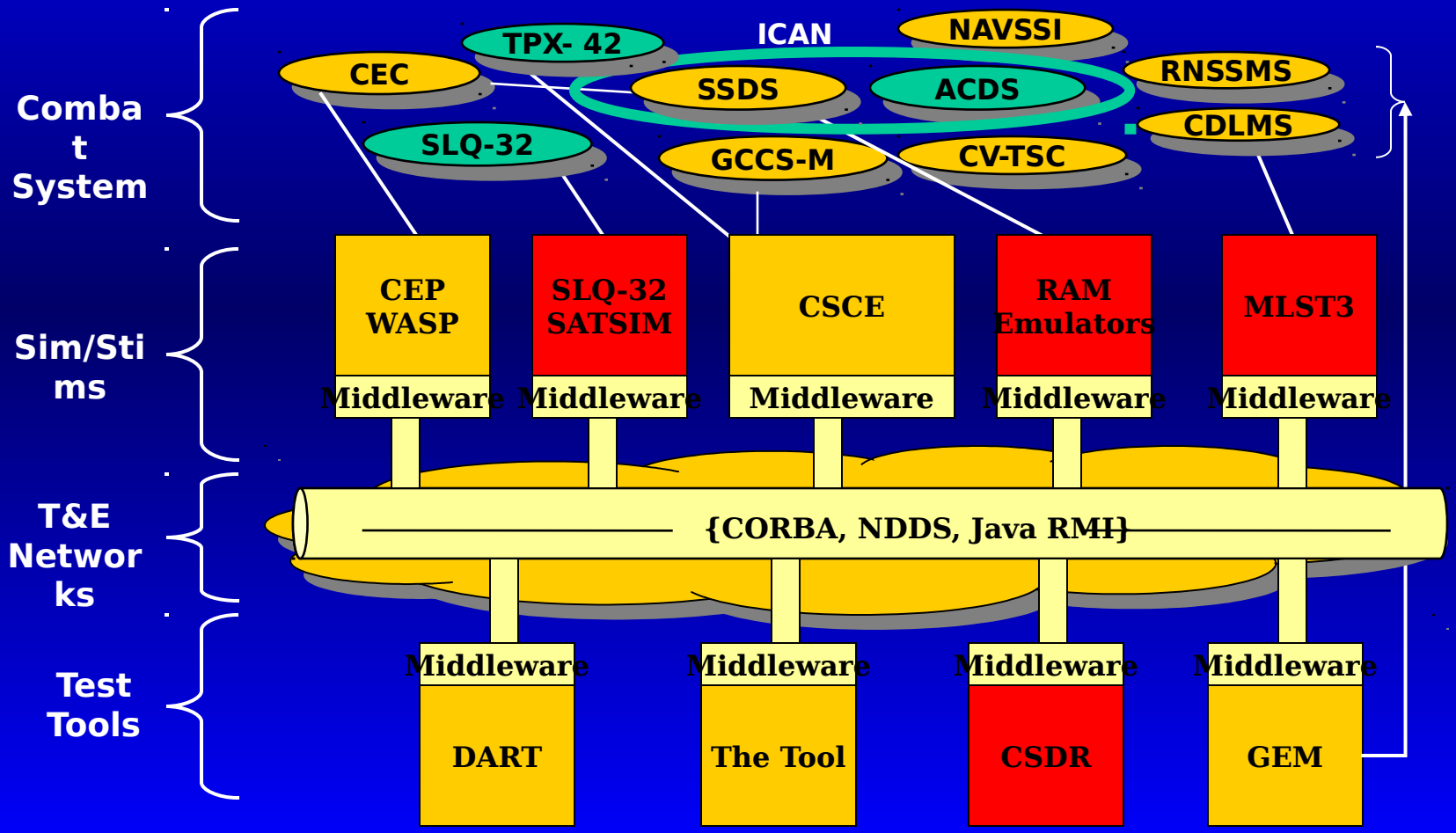
Future Direction with OSA Middleware

- Incorporate middleware in Sim/Stim and Test Tool environment
- Abstraction of interface and communication mechanisms from the hardware
- Leverage OODA paradigm (i.e. abstraction, reuse)



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Scalability Benefits

Current System

(CPU or I/O max'ed out)

New Requirements

(software, processing, additional I/O)

Solution

(add equipment)

MIL-STD/Computers

UYK-43

Additional $750K

COTS OSA

VME

Additional $15K (VME chassis & SBC)

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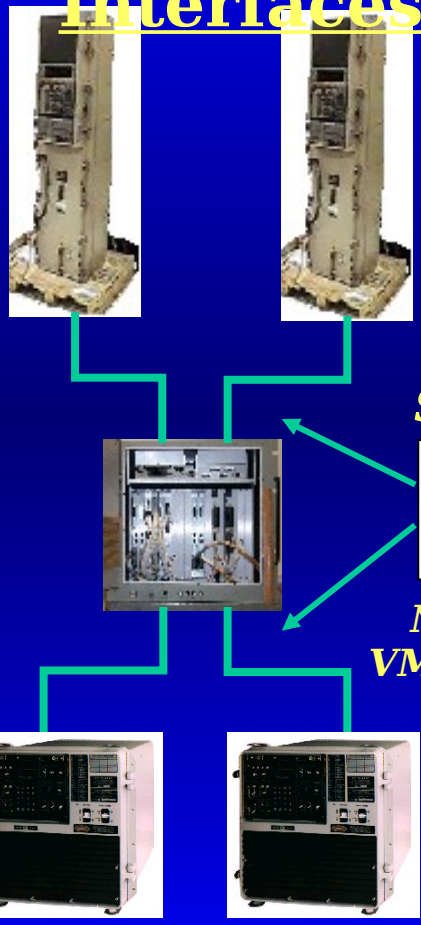
Interface Affordability

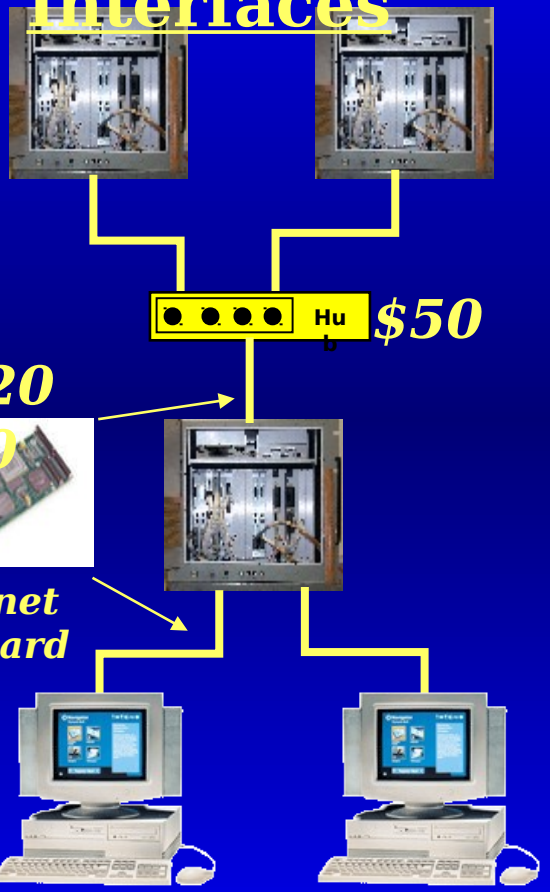
MIL-STD Interfaces



$500

NTDS VME card

COTS OSA Interfaces



$50

$20

Ethernet PMC card

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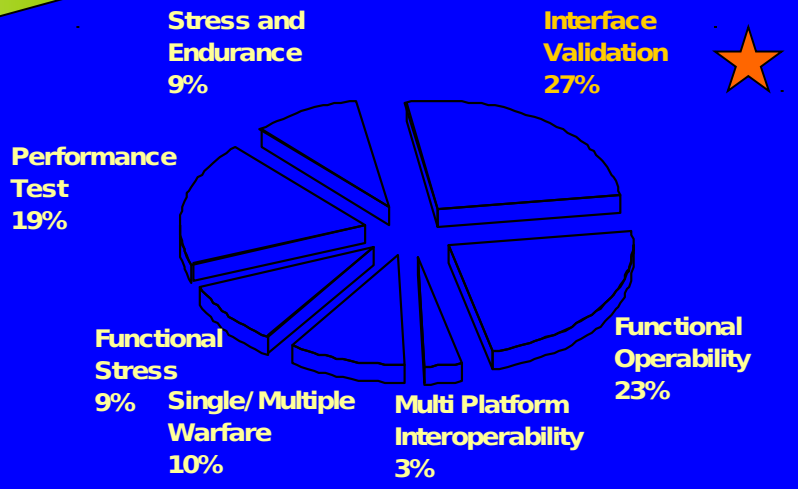
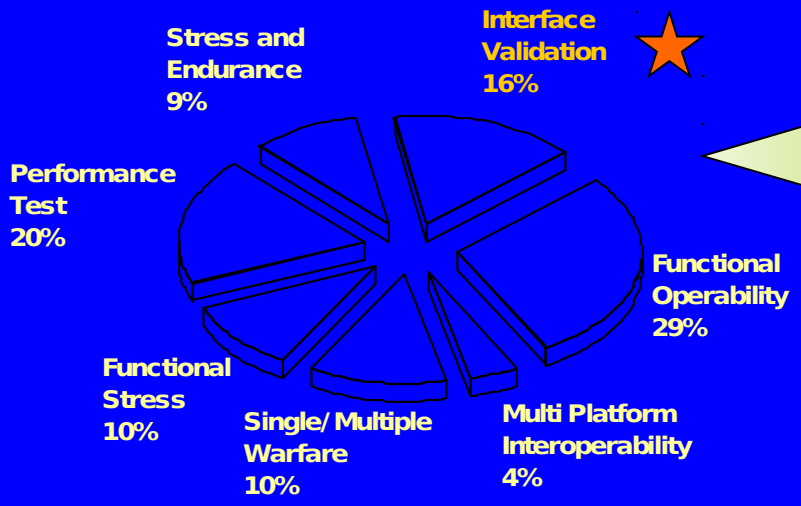
CSIT Benefits from using COTS O

MIL-STD CSIT

MIL-STD Interfaces Required each sub-contractor to program and "re-invent" the required interface protocols, thus consuming test time to integrate and debug.





Current CSIT with COTS OSA

Reduction in MIL-STD interfaces allows more CSIT time for higher level functionality testing in the application layer.

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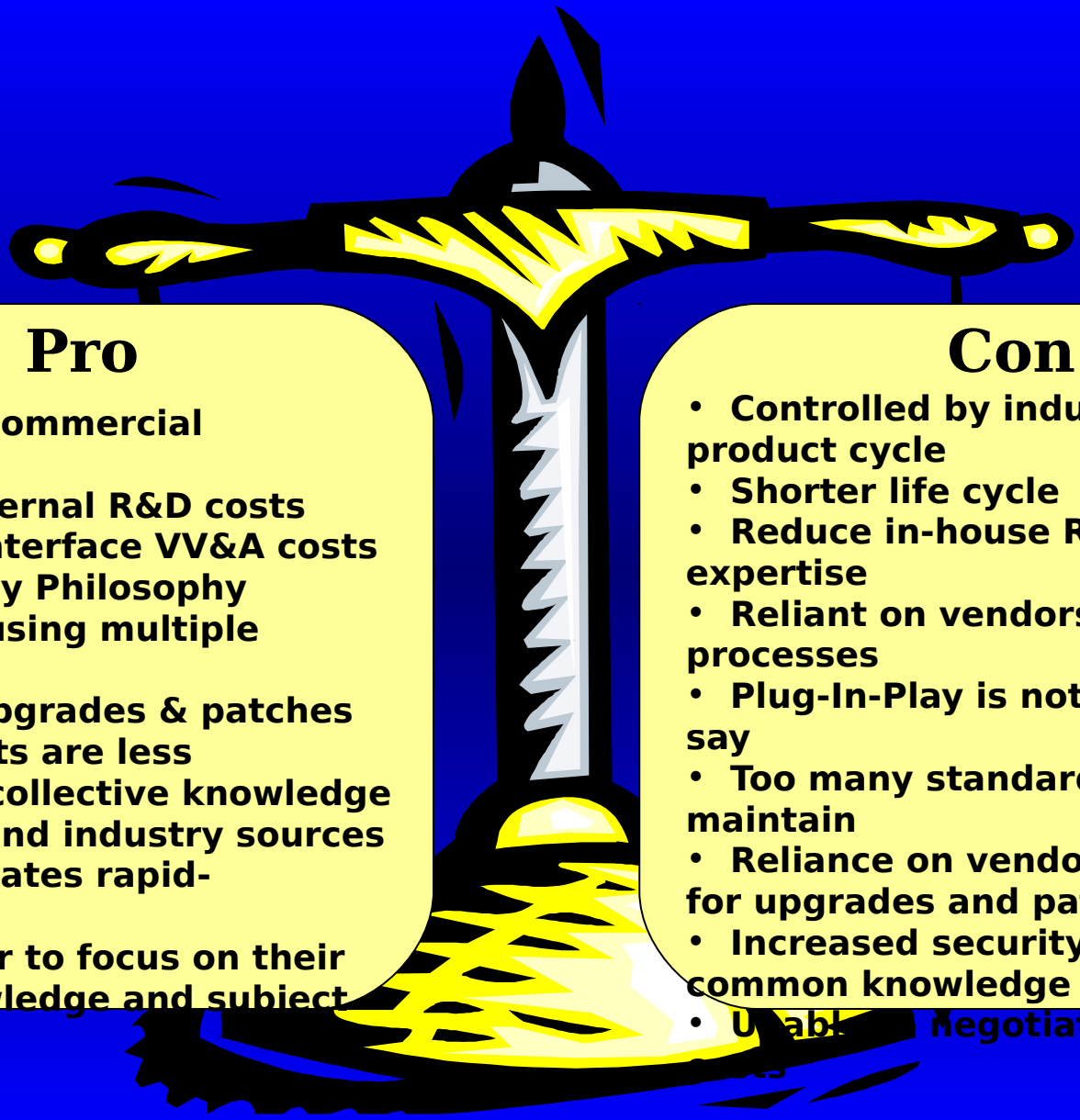
OSA T&E Tradeoffs



Pro

- Leverage commercial technology
- Reduce internal R&D costs
- Reduced interface VV&A costs
- Plug-In-Play Philosophy
- Option of using multiple vendors
- Industry upgrades & patches
- Repair costs are less
- Access to collective knowledge from public and industry sources
- Accommodates rapid-prototyping
- Allows user to focus on their domain knowledge and subject area

Con

- Controlled by industrial product cycle
- Shorter life cycle
- Reduce in-house R&D expertise
- Reliant on vendors VV&A processes
- Plug-In-Play is not what they say
- Too many standards to maintain
- Reliance on vendor schedule for upgrades and patches
- Increased security risk – common knowledge of standards
- U[illegible] Negotiate repair [illegible]

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Summary

- **Evolutionary progression of Naval Combat Systems**
  - Reduction of proprietary equipment and MIL-STDs
  - Increased usage of open systems and standards
- **Evolutionary progression of T&E Tools**
  - HWIL Sim/Stim environments lockstep with the combat systems
  - Data Collection and Analysis will continue to utilize OSA
  - Incorporating OSA middleware products
- **OSA Benefits and Tradeoffs**
  - Scalability and affordability
  - Increased reliability of interfaces allows CSIT test events to focus on the complexity of the application layer
- **Comments – “last nickels”**
  - CSIT test approach will evolve to support tech refresh of OSAs
  - T&E support of future combat systems will require the use of OSAs
  - Adoption of OSAs will require more government participation in the standard working groups and conferences to ensure representation

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“Jacta alea est” (the die is cast)

COTS OSA is here to stay - there’s no turning back!

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BACKUP SLIDES

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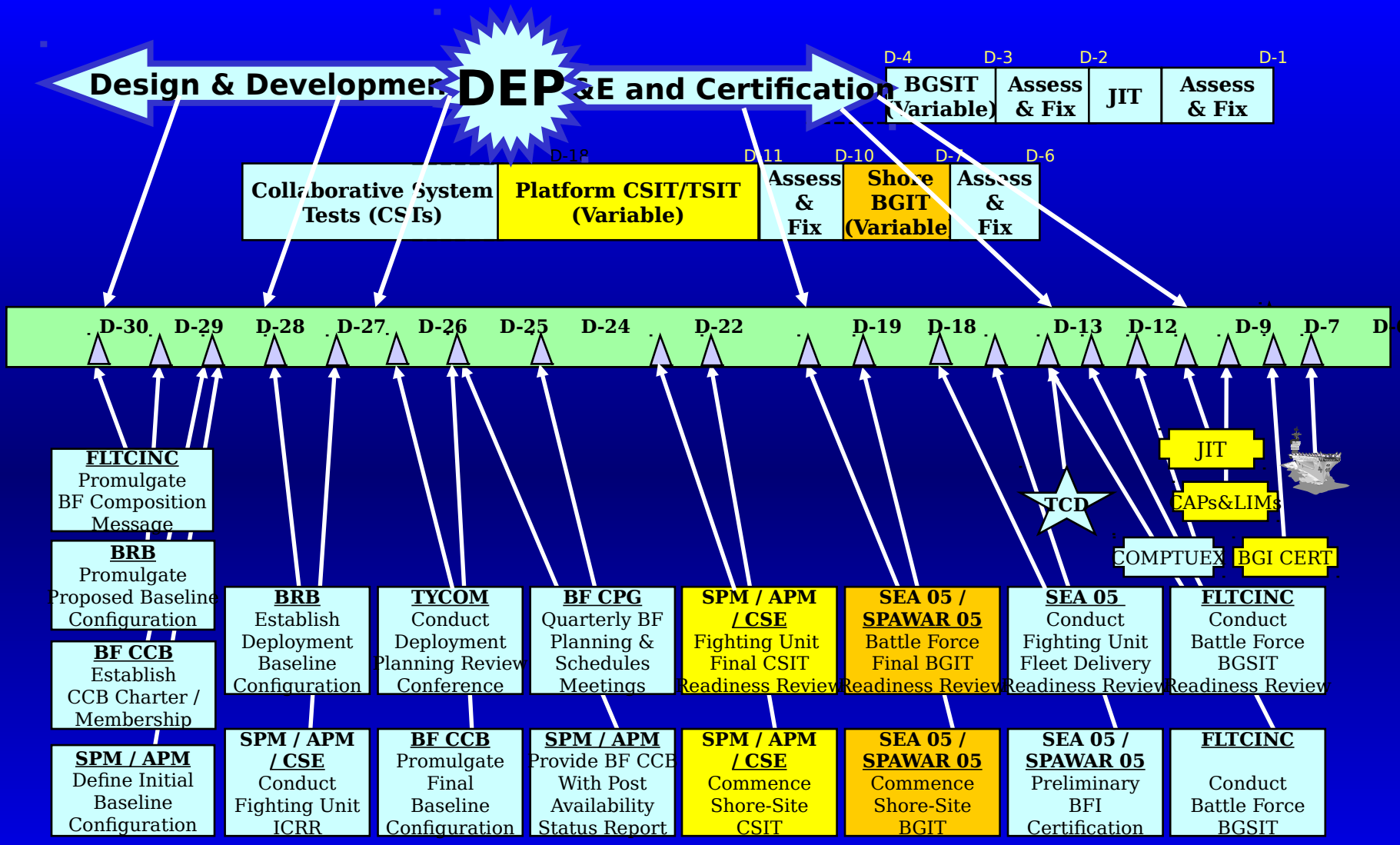
CSIT & BGIT within the D-30 Process



* CINCLANTFLT/CINCPACFLT Instruction 4720.3A of 27 April 00